

## THE DEVELOPMENT OF STUDENT WORKSHEET BASED ON GUIDED INQUIRY ON “COLLISION LAB” VIRTUAL EXPERIMENT TO IMPROVE HIGH SCHOOL STUDENT LEARNING OUTCOMES

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### Abstract

The purposes of this study is to create a feasible student worksheet based on guided inquiry on virtual experiment “Collision Lab” to improve high school student’s learning outcome in Lamongan region. The feasibility of this student worksheet is based on validity, effectivity, and practicality. The research type used is the development research ADDIE model. The result of research shows that validity of the student worksheet over all is 86,28%, categorized as very valid, which include, feasibility of content is 85,42%, feasibility of presentation is 87,50%, feasibility of language is 85,42%, and feasibility of design is 86,81%. This student worksheet is very effective shown in the result of teacher activities is 84,62%, the result of students activities is 90%, and the improvement of student’s learning outcomes by average score gain pre-test and post-test is 0,73 categorized as high. Practicality of this student worksheet is based on student’s response to student worksheet based on giuded inquiry that developed is 98% categorized as excellent. So we can conclude that student worksheet based on guided inquiry on “Collision Lab” virtual experiment is very feasible and can improve student’s learning outcomes.

**Keywords:** Student Worksheet, Guided Inquiry, Virtual Experiment, Collision Lab, Students’s Learning Outcomes.

### INTRODUCTION

Education has an important role in preparing the next generation. Education is not only used as a means of forming students who have high knowledge but also students who have attitudes and skills that have competitiveness. Entering the era of globalization, in the future our students will not only compete with fellow students from our own country, Indonesia, but also students from all around the world. This increased of competition has made the government to develop education curriculum in Indonesia from time to time. Currently education in Indonesia implements the 2013 curriculum.

In the 2013 curriculum, now the students are the center of learning and should be active. Students themselves must be active in finding problem solving and building ideas or concepts through the process of investigation or experiment. In this case the teacher only acts as a mentor and provides assistance as necessary in the process of investigation. In the curriculum 2013 also emphasized the scientific approach 6M (*Mengamati, Menanya, Mencoba, Mengasosiasi, Mengkomunikasikan, dan Mencipta*). It is also necessary to perform experimental skills. In the learning activities will be done

by using guided inquiry model. The scientific approach is designed to enhance the students' skills in conducting investigative activities using scientific capabilities (Madlazim, et al, 2014).

All this time, the teaching materials of momentum and impulse, especially the collision have never been held in most high school laboratories. This is due to the tools that are less practical to support these activities. Though pre-action activities can not only be done in real but also virtually.

In the current era of globalization, technological developments are increasingly sophisticated. Currently lab work can be done not only in real but virtual with the help of technology. This virtual practice can make it easy for us to experiment on materials that tools and materials are not available in the laboratory. Applications for virtual experiments are now freely accessible, such as Phet, sciencecourseware software or by visiting website sciencecourseware.com, etc.

In general, the source of learning used by students is Student Worksheet or student book. A Student Worksheet should be a guide for students to understand the concept of the material and to train the skills to be learned. One of the activities in the Student Worksheet is

an experimental activity. Experimental activity consists of two types, real experiment and virtual experiment. Generally the a guides or student worksheet for virtual experiment in the previously mentioned apps is using English. Whereas we know the ability of our high school students in English is less adequate. This Student Worksheet was developed to be easily understood by students so they could conduct virtual experiments more easily. In addition, based on the current curriculum 2013 students are more required to be able to learn independently. With the existence of good and feasible LKS students are expected to perform experiments independently, although outside the classroom or at home.

Pre-research activities were conducted by interviewing several teachers and students from different schools. This activity is done to find the facts in the field. The results obtained from this activity indicate that most teachers do not include experiment activities on the material momentum and impulse. This can be caused by several things, such as unavailability of the tool or the teacher can not ask students to make their own tools due to the price of less affordable tool components. In fact, to solve this problem teachers can use the Collision Lab available on the Phet app to conduct virtual experiments.

Based on previous studies such as research conducted by Kang Loo Wee (2015) entitled "One-Dimensional Collision Carts Computer Model and its Design Ideas for Productive Experiential Learning" shows that the use of virtual labs in the collision experiment gets positive feedback from students. In addition to the research students conducted by Widi Cahya Adi, Suratno and Mochammad Iqbal (2015) entitled "*Pengembangan Virtual Laboratory pada Pokok Bahasan Sistem Ekskresi dalam Meningkatkan Motivasi Belajar Siswa Kelas XI SMA Negeri 2 Bondowoso*" showed that the Virtual Laboratory significantly influence the motivation to learn students and increased students' motivation after using the Virtual Laboratory media. The research entitled "*Pengembangan LKS Memanfaatkan Laboratorium Virtual Pada Materi Optik Fisis Dengan Pendekatan Saintifik*" yang dilakukan oleh Ana Kurnia Sari, Chandra Ertikanto, dan Wayan Suana (2015) shows that LKS is very interesting, easy, and very useful, and effective product as a learning media with percentage student learning outcomes of more than 80% have achieved graduation in cognitive and affective aspects. Research by Istiqomah Nuraini (2014) entitled "*Penggunaan LKS Berbasis Guided Inquiry Untuk SMA Kelas XI Pada Konsep Sistem Sirkulasi*" shows that by using LKS student become more active and can mengkontruksi its own understanding. Research by Akbar Perdana, Siswoyo, and Sunaryo (2017) entitled

"*Pengembangan Lembar Kerja Siswa Berbasis Discovery Learning Berbantuan Phet Interactive Simulations Pada Materi Hukum Newton*" shows that the student worksheet that developed is very well and feasible to be used as learning resource in learning activities. And the research entitled "The Development Of Student Worksheet Assisted By Interactive Multimedia Of Photoelectric Effect To Build Science Process Skills" conducted by Payudi, Chandra Ertikanto, Noor Fadiawati, Agus Suyatna in 2017 showed the results that LKS developed effectively to improve student learning outcomes.

Based on what has been mentioned above, the authors are interested in conducting research by developing a Student Worksheet based on guided inquiry on "Collision Lab" virtual experiments to improve high school student's learning outcomes.

The purpose of this reseach is to create a feasible student worksheet based on guided inquiry on "Collision Lab" virtual experiment to improve student learning outcomes.

## METHOD

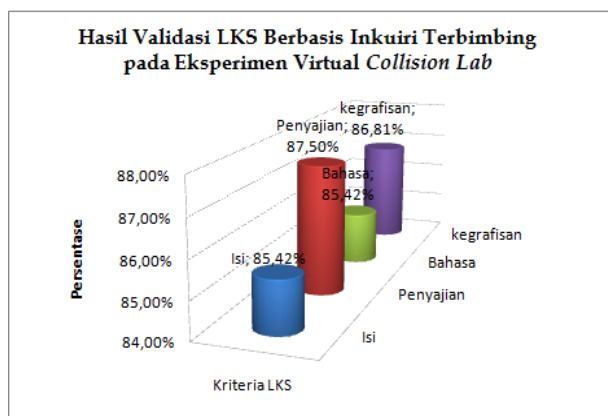
This research is a development research using ADDIE model. This ADDIE model has 5 phases consisting of: Analysis, Design, Development, Implementation and Evaluation (Sink, 2014). This research develops Guided Student Worksheets based on guided inquiry in "Collision Lab" virtual experiments to improve high school student learning outcomes. The developed Student Worksheet is reviewed and validated by two expert lecturers. Then the Student Worksheet is implemented using one group pre-test post-test desing to 10 high school student grade X in Lamongan region. The research instrument used is interview sheet, validation sheet, observation sheet of teacher and student activity, test sheet, and student response questionnaire. Data analysis techniques in this study using quantitative descriptive analysis techniques.

## RESULT AND DISCUSSION

From the research that has been done, the data obtained the feasibility of Student Worksheet that includes the validity, effectiveness, and practicality. Here are the results and discussion of the data.

### A. Validity of The Development of Student Worksheet

As one of the feasibility measures of the Student Worksheet, the validity of this Student Worksheet is done based on several criteria. The results of Student Worksheet validation presented in the **Figure 1**:



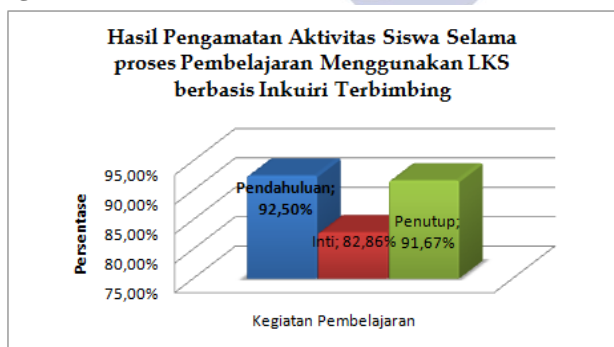
**Figure 1** Results of the Validation of Student Worksheet

Based on the results of validation conducted by the expert team obtained overall 86,28% (Feasibility of the contents of 85,42%, feasibility of presentation 87,50%, feasibility of language 85,42%, and feasibility of design 86,81%) categorized very feasible. This result show that the student worksheet that developed meets the standart of component and criteria of feasibility set by Depdiknas 2004.

## B. Results of Effectiveness of Student Worksheet

### 1. Observation of Teacher and Student Activity

Based on the observation data of teacher activity obtained, shows that 84,62% of all aspects observed have been implemented by the teacher. Using Likert-scale analysis, teacher activity during the learning process is categorized as excellent. All the phases in guided inquiry learning have been done by the teacher. The result of observation of student activity obtained is presented in **Figure 2**.



**Figure 2** Observation Results Student Activity

Based on the 3 points, it is obtained that the average of the whole students is 90% of the maximum score of all aspects of observed activity. Percentage of preliminary activities 92.50%, core activities 82.86%, and closing activities 91.67%. this result is relevan with the research done by Istiqomah Nuraini (2014) entitled “Penggunaan LKS Berbasis Guided Inquiry Untuk SMA

Kelas XI Pada Konsep Sistem Sirkulasi” shows that by using LKS student become more active and can mengkontruksi its own understanding.

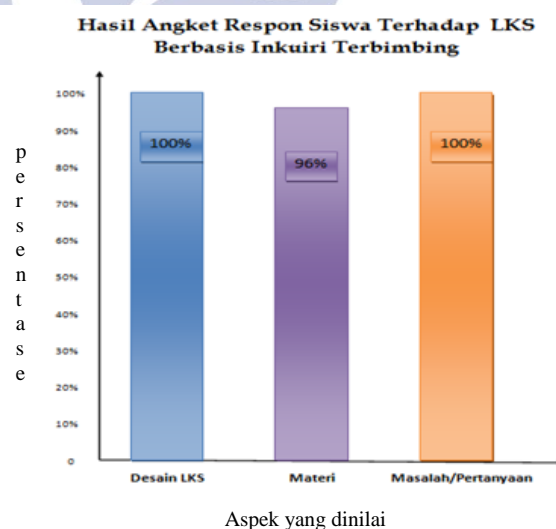
### 2. Student Knowledge Test Results through Pre-test and Post-test

Based on the data, obtained the average pre-test value is 28,40 and post-test value is 82,20. Further data were analyzed using a gain score to find out the improvement of student’s knowledge. From the data obtained score of each student's gain is in the range 0.50-0.93 with medium-high category and average score of gain in one class is 0.73 categorized as high. Student learning completeness classically in the learning of Collision is 100%.

From these results, shows that the student worksheet that developed can improve student learning outcomes of on learning Collision. This result is relevan with the result of the research entitled The Development Of Student Worksheet Assisted By Interactive Multimedia Of Photoelectric Effect To Build Science Process Skills” conducted by Payudi, Chandra Ertikanto, Noor Fadiawati, Agus Suyatna in 2017 showed the results that LKS developed effectively to improve student learning outcomes.

### C. Practicality of Student Worksheet

Practicality of student worksheet is shown in the result of student response to student worksheet. Student responses obtained are presented in **Figure 3**:



**Figure 3** Student Response to Student Worksheet

Based on the results of the data, obtained a very positive student response with an overall average of 98% which can be detailed by the percentage of each category, namely: 100% LKS design, 96% material and 100% question/problem, in Likert scale can be categorized as exellent. This result is relevan with the research done by Kang Loo Wee (2015) entitled “One-Dimensional



Collision Carts Computer Model and its Design Ideas for Productive Experiential Learning” shows that the use of virtual labs in the collision experiment gets positive feedback from students.

### Conclusion

Based on the result of the research, the development of Student Worksheet based on Guided Inquiry on “Collision Lab” virtual experiments that have been done and discussed, obtained the following conclusion:

1. The validity of Student Worksheet based on Guided Inquiry that developed overall is 86.28% (feasibility of content is 85.42%, feasibility of presentation is 87.50%, feasibility of language is 85.42%, and feasibility of design is 86.81%) .
2. The effectiveness of Student Sheet based on guided inquiry that developed can be said to be very effective. It is shown in the result of teacher activities is 84.62%, the result of students activities is 90%, and the improvement of student’s learning outcomes average gain score of pre-test and post-test knowledge is 0.73 categorized as high.
3. Practicality of student worksheet based on student’s response to Student Worksheet based on guided inquiry that developed is 98% categorized as excellent.
4. The student worksheet based on guided inquiry on “Collision Lab” virtual experiment that developed is very feasible and can improve student’s learning outcomes

### Suggestion

For further research, it may be a reference to create a student worksheet based on guided inquiry using virtual and real laboratories on other materials. For other researcher, make sure the computer or laptop have the application or software needed to run virtual experiment.

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